MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

TCE 1111 – DIGITAL SYSTEMS

(All sections / Groups)

6th October 2015
2.30p.m. – 4.30p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages including cover page with **6** Questions only.
2. Answer **ANY 5** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

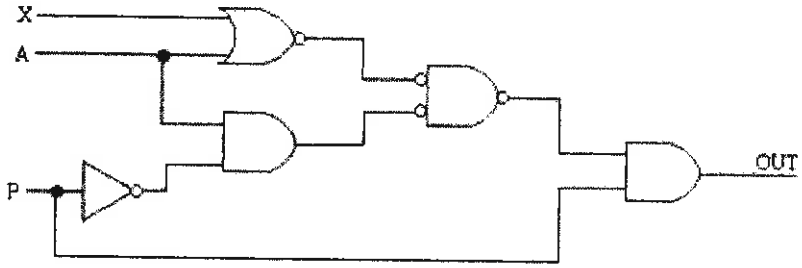
QUESTION 1

(a) Convert the decimal numbers 7777_{10} and 5555_{10} to Octal. Perform addition and subtraction operations on the converted Octal numbers. [4 Marks]

(b) Perform the following conversions. Show all necessary steps.

(i) Binary 10010100_2 to BCD [1 Mark]
(ii) Hexadecimal $5DFA_{16}$ to Binary [1 Mark]
(iii) BCD 1001_{BCD} to Excess-3 [1 Mark]
(iv) Binary 10110010_2 to Gray [1 Mark]

(c) Given the following logic circuit.



(i) Determine the output expression for the given logic circuit. [1.5 Marks]
(ii) Simplify the output expression obtained in (i) using Boolean laws, rules and theorems. [2.5 Marks]

QUESTION 2

(a) Design a code converter circuit to perform 3-bit Gray-to-Binary code conversion.

Your answer should include:

(i) Truth table with all possible combination of inputs and outputs. [2 Marks]
(ii) Simplified Boolean expressions for the binary outputs. [3 Marks]
(iii) Simplified logic diagram. [1 Mark]

(b) Express (-11_{10}) as an 8-bit number in the following representation:

(i) Sign-magnitude form [1 Mark]
(ii) 1's complement form. [1 Mark]
(iii) 2's complement form. [1 Mark]

(c) Perform `11100111 - 00010011` in 2's complement form. [2 Marks]

(d) Attach an odd parity bit at the MSB of the 1001111011. [1 Mark]

Continued .....

QUESTION 3

(a) Simplify the following function using K-map. Draw the logic circuit for the simplified logic expression.

$$F(A,B,C,D) = \Sigma(1,3,7,11,15) \text{ with } \textit{Don't Care } D(A,B,C,D) = \Sigma(0,2,5)$$

Your answer should include
(i) Truth table for function F. [2 Marks]
(ii) K-map simplification. [2 Marks]
(iii) Simplified logic circuit. [1 Mark]

(b) Implement function F using a 4 x 1 multiplexer. Your answer should include a truth table and an implementation circuit. [4 Marks]

$$F(x,y,z) = \Sigma(0,2,5,7)$$

(c) Design a 4-bit Parallel Subtractor using only Full Adders. [3 Marks]

QUESTION 4

Based on the given sequence, design a 3-bit Synchronous counter using JK flip flops.

0, 1, 4, 6 and then recycle to 0
Undesired states go to 0

(a) Draw the state transition diagram. [1 Mark]

(b) Derive the PRESENT and NEXT state tabulation (J_C K_C J_B K_B J_A K_A) where C is MSB and A is least significant bit (LSB). [4 Marks]

(c) Simplify each JK flip-flop input using Karnaugh Map. [4 Marks]

(d) Draw the logic diagram using JK flip-flops for the simplified expressions. [3 Marks]

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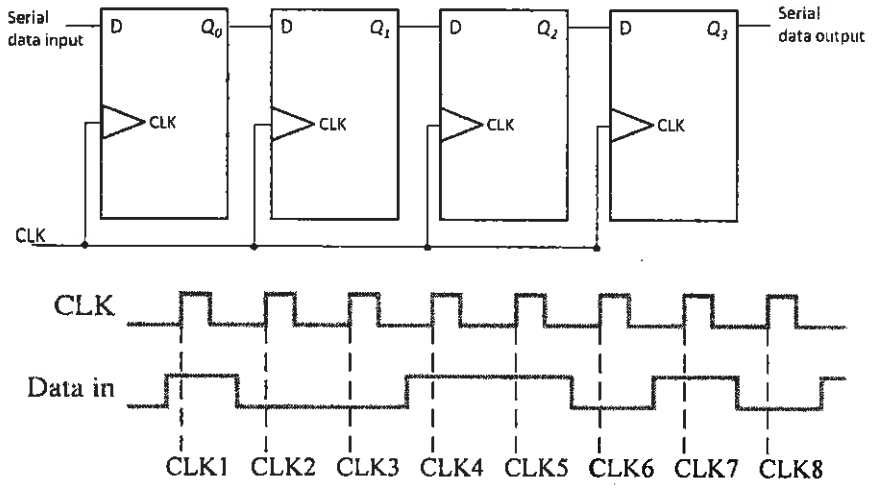
QUESTION 5

(a) For each of the eight clock pulses, determine the states of 4 flip-flops in the SISO shift register. Assume that the initial state of the shift register is 1010. [4 marks]



(b) Design an asynchronous decade counter using negative-edge triggered flip-flops. [4 Marks]

(c) Given the following POS expression.

$$X = (A + \overline{C})(A + B)$$

(i) Convert X to standard POS form. Show all necessary steps. [2 Marks]
(ii) Convert standard POS obtained in (i) to standard SOP expression. Show all necessary steps. [2 Marks]

QUESTION 6

(a) Implement a full adder using a 3x8 decoder. Your answer should include
(i) Truth table of a full adder [2 Marks]
(ii) Sum and carry functions expressed in sum of minterms [2 Marks]
(iii) Decoder implementation [2 Marks]

(b) Describe two characteristics of a flash memory. [2 Marks]

(c) List two analog-to-digital conversion (ADC) methods. [2 Marks]

(d) State two major differences between a SRAM and DRAM. [2 Marks]

End of Paper